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(54) Mobile wireless transceiver and transfer method

(57) Information transmitted from an information origin is transferred from one mobile station to another. At this time, in the mobile station, the transmission of the information is controlled so that the information is not transmitted to a distance more than a predetermined value from the position of the information origin. A valid period of the information is defined and only the information within the valid period is transmitted. Alternatively, controls are carried out in order to avoid overlapping of the transfer paths and detours of them. Particularly, if a density of the mobile stations becomes high, the quantity of the information to be transferred increases tremendously. Therefore, it is necessary to select and limit the information to be transferred. If the mobile station is a portable information terminal and a personal user has this portable information terminal, the information origin is a retail store and transmits special sale information and the like as well as position information. The user holding the portable information terminal may go to the special sale store after seeing the special sale information, and if he feels no interest in it, he leaves the special sale store. When the user is walking on the street after leaving the store, the portable information terminal held by the user who was in the store exchanges information with an information portable terminal of the other users. While repeating the exchange of the information, the information reaches to a person who has an interest in the special sale information.

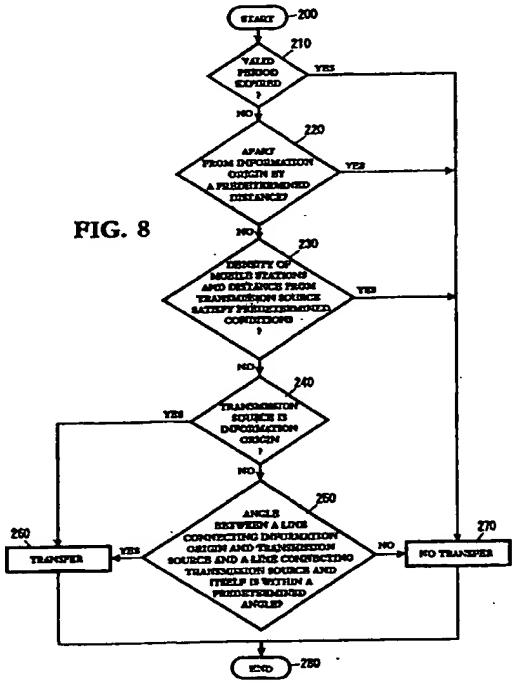

FIG. 8

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Description

[0001] Th present invention relates to a wireless communication system in which a mobile station relays a wireless signal sent from a base station to other mobile stations and more particularly to a method for transferring a wireless signal among the mobile stations in such a wireless communication system.

[0002] Japanese Published Unexamined Patent Application No. 9-252277 discloses a method for transferring signals between mobile stations. With reference to Fig. 1, this prior art describes that information transmitted from the fixed station is first received by the mobile station A and the information is processed by the station A. Then, the information is relayed to the mobile station B. Thereafter, the information is sequentially relayed to the mobile stations C and D from the mobile station B. In such a manner, it becomes possible to transmit the information in a wide area with a small power by relaying the information. Moreover, the value of a re-transmitting counter is included in a transmitting frame, and the value of the re-transmitting counter is incremented by one after every relay. It is determined, according to the value of the re-transmitting counter whether the information is to be relayed or not. This gazette describes that the information can be localized by doing so. However, a problem may be created if whether or not the information is to be relayed is determined based on the number of relays. For example, if the relay is performed among the mobile stations located at short distances, there has been a problem that the limitation to the number of relays is reached before the information has propagated far from the fixed station.

[0003] Furthermore, the following prior art is also disclosed in Japanese Published Unexamined Patent Application No. Hei 10-32538. With reference to Fig. 2., this patent application states that the mobile object CR1 collects data as to the present position and time from the GPS apparatus GP1 during its running, and based on the data the running locus (course) until now, the average speed, the spent time, the degree of the traffic congestion and the like on the course are stored in the memory MM1 as traffic information message MS1. Moreover, this patent application includes the following description relating to Fig. 3. "It is assumed that the mobile object CR1 and the mobile object CR2 approach in a distance so that they are capable of communicating with each other. The mobile object CR2 sends the traffic information message MS2-2 stored therein to the mobile object CR1, and the mobile object CR1 sends to the mobile object CR2 the traffic information messages MS1 which are possessed by the mobile object CR1 and the mail information message MS6 addressed to the computer, which is to be transmitted. Among the traffic information message MS1 received by the mobile object CR2 important parts for the mobile object CR2 are displayed on the display device DS2 as newly-received information. Similarly, among the traffic inf rmation message MS2-2 received by the mobile object CR1, important parts for the mobil object CR1 ar displayed on the display devic DS1 as newly-received information". Moreover, this prior art includes the following descriptions. "Although the message transfer system of this embodiment possesses no guarantee for data arrival, essentially, the arrival rate must be increased as high as possible". Since there are actually many mobile objects running in the same area, traffic information data concerning a certain area/route will be sequentially updated to the latest data. Particularly, in the case where traffic snarls occur like as in Japan, other mobile objects are always present around a certain mobile object, it will be possible to exchange messages with substantially the same high speed and in the same wide range as those in a wired network". Moreover, there is a description in which since instant messages need not be transmitted in a wide range, the messages are not stored for a long time and are soon deleted. However, there is no description in which it is judged how instant the messages are and at what time the messages should be deleted. Furthermore, there is no description as to the problem if many mobile stations are mal-distributed.

[0004] In the background arts described above, the mechanism by which the information transmitted from either the base station or the fixed station is exchanged among the mobile stations is disclosed. However, only the fact that the processing in the mobile stations to control the propagation of the information is performed by the number of times of relays is disclosed. Accordingly, an object of the present invention is to provide a method for controlling the propagation of information in an improved manner.

[0005] The present invention is defined in the claims appended hereto.

[0006] The system that is the basis for the present invention is analogous to that of the foregoing background arts. Specifically, the information sent by the base station (the fixed station in Fig. 1) as shown in Fig. 1 is hopped, for example, from the mobile station A to the mobile station B, from the mobile station B to the mobile station C, sequentially, whereby the information propagates from the mobile station A to the mobile station C. As shown in Fig. 2, each mobile station has at least the antenna AT1, the display device DS1, the receiver RX1, and the transmitter TX1, and receives wireless signals by the receiver RX1 via the antenna AT1 and presents the information necessary for the user of this mobile station among the received wireless signals to the user with the display device DS1. On the other hand, the mobile station transmits the wireless signal including specific information to other mobile stations from the transmitter TX1 using the antenna AT1. As shown in Fig. 3, when the mobile station CR2 communicates with the mobile station CR1, the mobile station CR2 sends the received information MS2-2 to the mobile station CR1, and the mobile station CR1 sends the stored information MS1 and MS6 to th mobile station CR2. Thus, the informa-

tion is exchanged between the mobile stations CR1 and CR2.

[0007] As understood from the above descriptions, although the exchanges of the information among the mobile stations are performed almost similarly to the background arts, the present invention shows which information is propagated among the mobile stations. Specifically, in a mobile wireless transceiver, if it is determined whether or not a received information including a position information of an information origin transmitting information initially is to be transferred, the following steps are executed: calculating a distance from the information origin using the position information; comparing the distance with a predetermined threshold; and determining that the received information is not to be transferred if the distance is same as or longer than the predetermined threshold. Thus, the propagation of the information is limited to a specific area from the information origin, so that it is possible to transmit more localized information to users in a specific area.

[0008] As another aspect of the present invention, in a mobile wireless transceiver, if it is determined whether or not a received information is to be transferred, following steps are executed: judging whether a valid period of the received information is expired or not; and determining that the received information is not to be transferred if the valid period thereof is expired. Obsolete information shall not be transferred, so that an overflow of the transferred information can be prevented. Moreover, if the velocity of the mobile station is approximately constant, the propagation area of the information will be limited to a specific area remote from the information origin. In the background arts, the fact is recited, in which the instant information is not stored for a long period of time, and it is deleted. However, there is no description concretely reciting on how to judge whether the message is instant and at what time the instant message is deleted.

[0009] If the received information includes a transmitting time information of the information original initially transmitting the information, the step of judging whether a valid period of the received information is expired or not includes a step of judging by using the transmitting time information whether a predetermined time has passed from a transmitting time. If the received information includes information concerning a valid period time by the information original initially transmitting the information, the step of judging whether a valid period of the received information is expired or not includes a step of judging whether the present time has passed the valid period time or not.

[0010] As still another aspect of the present invention, in a mobile wireless transceiver, if it is determined whether or not a received information including a position information of a transmission source is to be transferred, following steps are executed: detecting a density of th mobile wireless transceivers in the vicinity; calculating a distance fr m the transmission source by using the position information of th transmission source; judging whether the density and th distanc satisfy a specific condition or not; and determining that the received information is not to be transferred if the density and the distance satisfy the specific condition. Thus, if the density of the mobile stations is high, the information from the mobile station located at a short distance from itself is not re-transmitted, whereby an overflow of transmitted information can be controlled, resulting in a more efficient information transfer.

[0011] It is conceived that the step of judging whether a density of the mobile stations and a distance from the transmission source satisfy a predetermined condition or not may include a step of judging whether the density is a specific value or more and the distance is a specific value or less. It is also conceived that the step of judging whether the density and the distance satisfy the predetermined condition or not may include a step of determining whether the density and the distance satisfy a predetermined relationship formula. Note that the predetermined relationship formula expresses that the retransmission is not performed in the case where the density of the mobile stations are high and the information from the mobile station in a short distance from the mobile station is received.

[0012] As still another aspect of the present invention, in a mobile wireless transceiver, if it is determined whether or not received information including position information of an information origin initially transmitting information as well as position information of a transmission source is to be transferred, following steps are executed: judging whether an angle formed by a straight line connecting the information origin and the transmission source and a straight line connecting the transmission source and the transceiver itself is within a specific value, by using on the position information of the information origin and of the transmission source; and determining that the received information is not to be transferred, if the transceiver itself is not within the specific value of the angle. Thus, it becomes possible to propagate the information to a remote place more efficiently, thus preventing an overflow of information which is transferred in a narrow area.

[0013] It may be conceived that the specified value of the angle is determined depending on the density of the mobile wireless transceivers.

[0014] As still another aspect of the present invention, in a mobile wireless transceiver, if it is determined whether or not received information including position information of an information origin initially transmitting information as well as position information of a transmission source is to be transferred, following steps are executed: detecting an average distance from other transceivers; judging whether the transceiver itself is within an area surrounded with two straight lines which contact with a circle, by using the position information of the information origin and th position information of the transmission source, th center of which is located at a

position apart from the transmission source by a rec iving limitation distance as well as on a straight line connecting the inf rmation origin and the transmission source, and the radius of which is equal to the average distance; and determining that the received information is not to be transferred if the transceiver itself is not with the area. Thus, it becomes possible to propagate the information to a remote place more efficiently, thus preventing a flood of the information which is transferred in a narrow area.

[0015] It can be also conceived that in this aspect, following steps are further executed: judging whether a distance from the transmission source is same to or longer than a value obtained by subtracting the average distance from the receiving limitation distance or not; and determining that the received information is not to be transferred if the distance from the transmission source is shorter than the value obtained by subtracting the average distance from the receiving limitation distance.

[0016] The above description of the present invention was made for processing in the mobile station. The present invention can be also implemented for a mobile wireless transceiver which executes such processing. Moreover, the present invention can be implemented for a program which executes such processing. Noted that the program is usually stored in memory devices such as a ROM (Read Only Memory) and storage mediums such as a CD-ROM.

[0017] Thus, as will be apparent from the following description, the propagation of the information is limited to a predetermined range. Furthermore, congestion of the information to be propagated is avoided. Generally speaking information is propagated more efficiently than in the prior art.

[0018] Embodiments of the invention will now be described with reference to the accompanying drawings in which;

Fig. 1 is a diagram illustrating a premise of the background art and the present invention;

Fig. 2 is a diagram illustrating a premise of the background art and the present invention;

Fig. 3 is a diagram illustrating a premise of the background art and the present invention;

Fig. 4 is a diagram showing an example of a transmission frame;

Fig. 5 is a block diagram showing an example of a mobile station in the present invention;

Fig. 6 is a diagram showing the case where no transmission of information is performed;

Fig. 7 is a flowchart for computing an average distance D among the mobile stations;

Fig. 8 is a flowchart for processing a judgement whether or not the mobile station transfer the information; and

Fig. 9 is a diagram for explaining a step 250 in Fig. 8.

[0019] As described above, the premise that the information including the program sent out from the base station (fixed station) is transmitted by hopping it among the mobile stations as shown in Fig. 1 is applicable to the present invention. Therefore, in the following, a description is made for information transmitted from the base station, the constitution of the mobile station and processing executed in the mobile station, which are features of the embodiments of the present invention.

(1) The Transmitted Information from the Base Station

[0020] The base station is analogous to a broadcast station, which transmits its advertisement information. As described above, in order that the information sent out from the base station is propagated to a specific area from the base station, the base station sends out either a position of the information origin or a time, or both of them along with the information to be transmitted. Moreover, a threshold value of either a distance or a time, which serves for discarding the information sent out, may be included therein. Alternatively, threshold values of both of them may be included. An example of a transmitting frame used in this embodiment of the present invention is shown in Fig. 4. When the base station transmits the information, the transmission source position 1 and the information origin position 5 are the same and the transmission source time 2 and the information origin time 6 are the same, respectively, so that any of them can be deleted. Moreover, since the base station does not move, the value of the transmission source speed 3 is deleted or made equal to zero. For the case of the mobile stations, it is preferable that a speed vector is inputted. Note that the transmission source speed 3 is provided optionally. The information category 4 is prepared by the information original. Bit arrays are previously made to correspond to the sorts that are, for example, an advertisement or a traffic information, and the bit arrays of the sorts corresponding thereto are inputted to the information category 4. The reason why such way is adopted is in order to make it possible for the user to easily filter the necessary information. The threshold value 7 is set by the information origin. In case of the threshold value concerning the distance, the distance from the information origin is inputted. In case of the threshold value concerning the time, either the time to be discarded or the time from the information origin time is inputted.

[0021] Although it was described that the base station is a broadcasting station or the like, the bas station may

not be the one which transmits information one-sidedly, but may be constituted such that it is connected in wireless with th mobile station to communicate information therebetween. Alternatively, the base station may have a relay function like a mobile station as described later. Moreover, in the above description, that the base station is an information origin was premised. However, it is possible that the mobile station itself serves as the origin of the information.

(2) Constitution of the Mobile Station

[0022] A block diagram showing an example of the mobile station is illustrated in Fig. 5. The transceiver 13 coupled to the antenna 11 is also connected to the communication controller 15. The display device 21 is connected to the display controller 17. The display controller 17 and the communication controller 15 are connected so as to control all of the mobile stations in cooperation with each other. Moreover, both are connected to the memory 19, and share the memory 19. The display controller 17 is connected to the input device 23. The communication controller 15 is connected to the position detector 25 and the time detector 27.

[0023] Although any kind of the transceiver 13 may be adopted, the transceiver 13 should be preferably one using radio (FM) waves, infrared ray communications (IrDA) and the like. The transceiver 13 checks the timing of the connection with other mobile stations or the base station together with the communication controller 15 to perform communication with them. GPSs and PHSs can be employed for the position detector 25. In the case where the mobile station is a car, car navigation systems can be employed. Moreover, in the case where a speed sensor and an acceleration sensor exist, they can be employed. The information concerning the position is either two-dimensional (latitude, longitude) or three-dimensional (latitude, longitude and height). The time detector 27 may be a clock, a device acquiring time information from the GPS, or a device acquiring a time from a radio clock. The communication controller 15 can calculate the speed information concerning the mobile station, using the information from the position detector 25 and the time detector 27.

[0024] Next, the operation of the mobile station will be described. The transceiver 13 receives a wireless signal via the antenna 11, and transfers the received signal to the communication controller 15. The communication controller 15 stores the received information in the memory 19. The communication controller 15 also informs the display controller 17 concerning the receipt of the new information and an address in the memory 19. The display controller 17 confirms whether or not the information is to be displayed. As result of the confirmation, if the information is to be displayed, the display controller 17 reads out the information from the specified address in the memory 19, and displays it on th display devic 21. Th user can designate th information to be displayed using th input devic 23. For example, if the user wants to know the traffic information, the user sets the display controller 17 so that the display device 21 displays the traffic information. Moreover, if information to be transmitted to other mobile stations exists in the memory 19, the communication controller 5 reads out the information from a specific address of the memory 19, and prepares the transmitting frame shown in Fig. 4. thus causing the transceiver 13 to transmit the information via the antenna 11.

[0025] Note that the communication controller 15 can also judge whether or not the communication controller 15 receives the entire frame, when the communication controller 15 receives the position information of the transmission source and the position information of the information origin located at the top of the frame shown in Fig. 4.

(3) Processing in the Mobile Station

[0026] The communication controller 15 selects the information to be transmitted. Specifically, the communication controller 15 determines for each information whether or not the information is to be transmitted. This processing is conducted in order to limit the propagation area of the information according to the distance from the information origin and the time as described above. In addition, since it is impossible to designate the communication route because of the communication conducted in the state where the locations of the mobile station and the base station are unknown, it is necessary to avoid the occurrence of a situation where the communication quantity is increased due to the overlapping of the transfer paths originating from high densities of both of the mobile stations and base stations. This situation is illustrated in Fig. 6, for example. In Fig. 6, the mobile stations A and B are within an area where the mobile stations are crowded closely, and from one of the mobile stations A and B, no information from the same information origin is transferred to the mobile station C in order to reduce the communication quantity. It is satisfactory that the information is transferred to the mobile station C via the mobile stations other than the stations A and B.

[0027] Although the overlapping of the transfer paths can be prevented by attaching identifiers to the mobile stations and the messages, this is not practical. This causes a problem that the messages become longer. The present invention performs processing for reducing the communication quantity, as well as for selecting the transfer information according to the distance and the time.

[0028] Prior to description of an algorithm for determining whether or not the information is to be transferred, the premise will be described.

(a) It is assumed that th mobile stations and th base stations are almost unif rmly distributed. Spe-

cifically, the average distances between the mobile stations and the base stations are approximately constant, and this averag distance is denoted by the symbol D. The way how to obtain the average distance D will be described later. The average distance D may change slowly in some instances.

(b) It is assumed that the number of times of transmission within a certain period of time is constant in the base station and every mobile station. This number of times of transmission information is denoted by N. The number of times N also may change slowly in some cases.

(c) It is assumed that a communication limitation distance (receiving limitation distance) between two mobile stations and between the mobile station and the base station is constant. This communication limitation distance is denoted by X. The communication limitation distance X may be obtained by actually measuring a radio wave receiving intensity in the mobile stations and the base station. The communication limitation distance X can be set to be a constant as performances of the mobile stations and the base station. Moreover, the communication limitation distance X may be a function of such as communication conditions at the circumferences and moving speeds.

[0029] Next, the way how to obtain the average distance D will be described (Fig. 7). First, frames which can be received are received within a predetermined period of time t (step 110). The period t shall be sufficiently long enough to satisfy an inequality Nt>1, and shall be sufficiently shorter than the period over which the average distance D changes. Using the position information of the transmission source in each frame and the position information from the position detector 25, the distances from the mobile stations or the base stations which have sent out the frame are calculated (step 120). After the predetermined time t has elapsed, it is confirmed whether or not a sufficient number of frames were received (step 130). If the distances for a sufficient number of frames could be calculated, an average of these distances is calculated. The value of the average distance is denoted by D (step 140). On the contrary, if a sufficient number of frames were not received, the calculated distances are averaged. The result of the calculation is corrected by considering the circumstances around the mobile stations such as the velocity, the position and the like (step 150). For example, when moving by a car, it is considered that the correction is performed using the distance between cars in accordance with the velocity. If the number of frames received is too small, it is considered that the value derived from the circumstances around the car is regarded as D, without the correction. Note that since the average distance D changes, this processing should be appropriately performed in accordance with the change of th circumstances and the average distance D should be updated.

[0030] An algorithm for determining whether or not the information is to be transferred, which is performed by the communication controller 15, will be described using Fig. 8. First, it is judged whether the valid period of the information to be determined whether it should be transferred (hereinafter referred to as a transfer information) is expired (step 210). If the valid period has expired, the information is nor transferred (step 270). The judgment whether or not the valid period has expired is performed in the following manner. Specifically, if a time is included, as a threshold value, in the frame of the transfer information, the judgment is conducted depending on whether or not this time has elapsed. If a time from the transmitting time of the information origin is included, as a threshold value, in the frame of the transfer information, a time at the valid period is obtained, and the judgment is conducted depending on whether or not this has elapsed. To obtain the present time, the time detector 27 is used. Note that the judgment whether or not the valid period has elapsed can be conducted based on a unique standard of the communication controller 15. For example, it is possible to design the communication controller 15 such that it holds the transfer information only for a predetermined period from the transmitting time of the transmission sources or the information origin.

[0031] Next, it is judged whether the mobile station itself is apart from the information origin by a predetermined distance or not (step 220). Using the distance included, as the threshold value, in the frame of the transfer information and the position of the information origin included in the frame, it can be judged depending on whether or not the position of the mobile station itself detected by the position detector 25 is positioned within a circle whose radius is equal to the distance as the threshold value and whose center is the information origin. If this mobile station is distant from the information origin by more than a predetermined distance, no transfer of the information is conducted (step 270). Note that the judgment of the possibility of the information transfer as to a distance can be made based on a unique standard of the communication controller 15, similarly to the judgment as to the time. For example, the communication controller 15 can determine depending on the peculiar distance from the transmission source or the information origin whether or not the transfer information is to be discarded.

[0032] Furthermore, it is judged whether the distance from the transmission source and the density of the mobile stations satisfy predetermined conditions (step 230). The purpose of performing this step is to determine not to perform the information transfer if the density of the mobile stations is sufficiently high and the distance from the transmission source is short. The density of the mobile stations can be replaced by the average distance D described above. Moreover, the distance from the transmission source can be obtained from the

position information of the transmission source included in the frame of the transfer information and the position information supplied from the position detector 25. For example, assuming that the distance from the transmission source be d, if the inequality $d < (1-D/X)X$ (X: the receiving limitation distance described above) is established, the procedure proceeds to the step 270. This inequality can be rearranged considering distribution of the density D and errors of the receiving limitation distance X of the wireless wave. For example, if the number of sample frames that are sources of the calculation of the average distance D is small, by introducing ε which satisfies the inequalities $0 << \varepsilon < 1$, the condition of the transfer impossibility can be relaxed as shown by the inequality $d<(1-D/X-\varepsilon)\cdot X$.

[0033] Furthermore, it is judged whether or not the transmission source is identical to the information origin (step 240). Subsequently, it is judged whether or not the angle between the straight line connecting the information origin and the transmission source and the straight line connecting the transmission source and the mobile station itself is within a predetermined angle (step 250). This implies the condition for propagating the information radially from the information origin so that the transfer paths do not make detours and overlap each other. Assuming that the position vector of the mobile station itself be r, the position vector of the transmission source be s, the origin of which is the information origin, this condition is expressed by the following inequality.

$$((r-s)\cdot s)/(|r-s||s|)>C>0$$

where $C=\cos\theta$, $\sin\theta = D/X$.

[0034] This condition is illustrated as shown in Fig. 9. In Fig. 9, since the mobile station a is within the area of a predetermined angle θ from the straight line connecting the information origin and the transmission source, that is, since $\psi < \theta$ is established in this case, the transfer information can be transmitted (step 260). Moreover, this condition can be expressed by whether or not the mobile station a is within the area between the two straight lines, which contact with a circle whose radius is equal to the average distance D and whose center is apart from the transmission source by the receiving limitation distance X and on the straight line connecting the information origin and the transmission source. On the other hand, since the mobile station b is not within the area of the predetermined angle θ, that is, since $\phi > \theta$ is established in this case, the transfer information is not transmitted (step 270). As an alternative condition, the mobile station itself is within the circle in Fig.9 and an area which is apart from the transmission source and outside the circle, that is, the condition that the distance of the mobile station from the transmission source is longer than the value obtained by subtracting the average distance from the receiving limitation distance may be adopted.

[0035] Not that the above-described inequality is an example, and the predetermined angle θ may be determined independently from the average distanc D and the receiving limitation distance X. Furthermore, the possibility of the information transfer can be determined by any one of the steps 210, 220, 230, 240 and 250, or it can be determined by an arbitrary combination of them. Moreover, the order of the steps can be changed arbitrarily. The conditions can be expressed by dividing the formulae into more than two.

[0036] When the information is sent out at a place where the density of the mobile stations is extremely high, the case where the information is discarded without transferring it may be expected. In such case, it is sufficient that the information origin sets the threshold value of the distance to be 0 or the transmitting time and the discard time are made to be equal.

[0037] By the operation of the communication controller 15 as described above, it is possible to determine for every information the possibility of the information transfer.

[0038] Next, the application example of the present invention will be described. It is assumed that the mobile station is a portable information terminal and the personal user has this portable information terminal. For example, the information origin is a retail store, and it sends out special sale information or a shop information together with the position information. The user holding the portable information terminal may visit the special sale shop upon getting the special sale information. If he does not have an interest for the special sale shop, he will leave the shop. When this user walks on the street after leaving the shop, his portable information terminals exchanges information with portable information terminals of other users. While repeating the exchange of the information, the information will be received by a user who feels interest for the special sale information. The portable information terminal automatically performs such an information transfer similar to a word-of-mouth communication, whereby information collection can be performed. Moreover, by sending out similar information by many shops, the holders of the portable information terminal can compare the special sale information, so that they can buy cheaper goods. Since the information spreads of itself by sending out it to a small number of users without transmitting it to many users at once, the shop which is the information original can gather customers in a low cost.

[0039] Furthermore, facilities for travel may be the information origins. For example, the facilities for travel send out departure and arrival guide information of trains, buses, airplanes and the like. The present invention exhibits effects in the case where schedules of them are disturbed. For example, the portable information terminals possessed by persons in a railway station receive information informing the delay of the train from the traffic facility, and if the persons in the railway station mov , the information is spread around th station.

Moreover, if the mobile station set in the bus receives information informing the delay of the train, or if a person holding a portable information terminal which has received the information informing the delay of the train gets on the bus, this information is transmitted along the bus route. If an portable information terminal of a person at the bus stop waiting for a bus running towards the station receives information informing the delay of the train, that person may think of using traffic facilities other than the train and not getting on the bus. As described above, if such situation occurs suddenly, it becomes possible to transmit local and real time information which can not be dealt with by televisions and radio broadcasts. Furthermore, it becomes possible to avoid the occurrence of a situation where the station is over crowded by people.

[0040] Furthermore as still another example, the mobile station may be a car. In this case, a portable information terminal is connected to the car, or a car navigation system possesses the function of the mobile station. The information origin may be a gas station or a parking zone. In the case of the gas station, the information origin transmits information concerning the location of the gas station and the cost of the gasoline. In case of the parking zone, the information origin transmits information concerning the vacant space. The information propagates from one car to another. For example, the information is transmitted from the car needing no oil supply to the car needing it, and the information is transmitted from the car planning for no parking to the car planning for it. In the parking zone and the gas station, information concerning restaurants, special sale information from retail stores and information concerning sight-seeing guides for this area can be acquired from other cars.

[0041] The transmission of the traffic information disclosed in the background arts may be employed. The traffic jam information is more localized and changes in real time, and it is transmissible by communications among the cars. Note that the users can serve as the information origin using an input device. Specifically, the users can immediately transmit information concerning an accident occurred by the car before their eyes to other cars, by inputting this information to the input device. Moreover, if the user have an image acquisition device such as digital cameras, it also becomes possible to transmit the acquired image to other mobile stations.

[0042] Thus as can be appreciated from foregoing, the transmission of information can be limited the information to a predetermined area.

[0043] Moreover, congestion of information to be transmitted can be avoided and still furthermore, more efficient transmission of the information can be achieved.

Claims

1. A method for determining in a mobile wireless transceiver whether received information including position information of an information origin is to be transferred to another mobile wireless transceiver, the method comprising the steps of:

   calculating a distance from the information origin to the mobile wireless transceiver using the position information;

   comparing the distance with a predetermined threshold value; and

   determining that the received information is not to be transferred if the distance is greater than or equal to the predetermined threshold value.

2. A method for determining in a mobile wireless transceiver whether information received at the transceiver is to be transferred to another mobile wireless transceiver, the method comprising the steps of:

   judging whether or not a valid period associated with the received information has expired; and

   determining that the received information is not to be transferred if the valid period of the received information has expired.

3. The method according to claim 2, wherein the received information includes information representing the time of transmission by an information origin, and the step of judging whether the valid period of the received information has expired or not includes a step of judging whether a predetermined time has elapsed from the transmission time by using the transmission time information.

4. The method according to claim 2, wherein the received information includes information concerning a valid time period from an information origin, and the step of judging whether the valid period of the received information is expired includes a step of judging whether the valid time period has expired.

5. A method for determining in a mobile wireless transceiver whether received information including position information of a transmission source is to be transferred to another mobile wireless transceiver, the method comprising the steps of:

   detecting a density of the mobile wireless transceivers in the vicinity;

   calculating a distance from the transmission source using the position information of the transmission source;

judging whether or not, the density and the distance satisfy a predetermined condition; and

determining that the received information is not to be transferred if the predetermined condition is satisfied.

6. The method according to claim 5, wherein the step of judging whether the density and the distance satisfy a predetermined condition includes a step of judging whether or not the density is greater than or equal to a predetermined value and the distance is less than or equal to a predetermined value.

7. The method according to claim 5, wherein the step of judging whether the density and the distance satisfy a predetermined condition or not includes a step of judging whether or not the density and the distance satisfy a predetermined relationship equation.

8. A method for determining in a mobile wireless transceiver whether received information including position information of an information origin and position information of a transmission source is to be transferred, the information origin primarily transmitting information, the method comprising the steps of:

judging whether an angle between a first line connecting the information origin and the transmission source and a second line connecting the transmission source and the mobile wireless transceiver itself is within a predetermined angle, using the position information of the information origin and the position information of the transmission source; and

determining that the received information is not to be transferred if the angle between the first and second lines is not within the predetermined angle.

9. The method according to claim 8, wherein the predetermined angle is determined based on a density of the mobile wireless transceivers in the vicinity.

10. A method for determining in a mobile wireless transceiver whether received information including position information of an information origin and position information of a transmission source is to be transferred, the information origin primarily transmitting information, the method comprising the steps of:

detecting an average distance from the mobile wireless transceiver itself to other mobile wireless transceivers;

using the position information of th information origin and the position information of the transmission source to judge whether th mobile wireless transceiver itself is within an area surrounded with two lines which contact with a circle whose center is located at a position apart from the transmission source by a receiving limitation distance of wireless signals as well as on a line connecting the information origin and the transmission source and whose radius is equal to the average distance; and

determining that the received information is not to be transferred if said mobile wireless transceiver itself is not within the area.

11. The method according to claim 9, further comprising the steps of:

judging whether a distance from the transmission source is the same as or longer than a value obtained by subtracting the average distance from the receiving limitation distance or not; and

determining that the received information is not to be transferred if the distance is shorter than the value.

12. A mobile wireless transceiver comprising:

a receiver for receiving a wireless signal of transfer information including position information of an information origin;

a transmitter for transmitting the wireless signal;

a position detector for detecting a position of the mobile wireless transceiver itself; and

a controller for calculating a distance from the position of the information origin to the position of the mobile wireless transceiver itself by using the position information, comparing the distance with a predetermined threshold value, and determining that the transfer information is not to be transmitted by the transmitter if the distance is greater than or equal to the predetermined threshold value.

13. A mobile wireless transceiver comprising:

a receiver for receiving a wireless signal of transfer information;

a transmitter for transmitting the wireless signal; and

a controller for judging whether or not a valid period of the transfer information has expired, and determining that th transfer information is not to be transmitted by the transmitter if the valid period has expired.

14. The mobile wireless transceiver according to claim 13, wherein the transfer information includes information representing the transmission time by an information origin, and the controller is operable to judge using the transmission time information whether or not a predetermined time has elapsed from the transmission time.

15. The mobile wireless transceiver according to claim 13, wherein the transfer information includes information concerning a valid time period specified by an information origin, and the controller judges whether or not the valid time period has expired.

16. A mobile wireless transceiver comprising:

a receiver for receiving a wireless signal of transfer information including position information of a transmission source;

a transmitter for transmitting the wireless signal;

a position detector for detecting a position of the mobile wireless transceiver itself; and

a controller for calculating a distance from the position of the transmission source to the position of the mobile wireless transceiver itself using position information of the transmission source, detecting a density of the mobile wireless transceivers existing in the vicinity using position information of the transmission sources of a plurality of wireless signals received by the receiver, judging whether the density and the distance satisfy predetermined conditions or not, and determining that the transfer information is not to be transmitted by the transmitter if the predetermined conditions are satisfied.

17. The mobile wireless transceiver according to claim 16, wherein the controller judges whether or not the density is greater than or equal to a predetermined value and the distance is less than or equal to a predetermined value.

18. The mobile wireless transceiver according to claim 16, wherein the controller judges whether or not the density and the distance satisfy a predetermined relationship formula.

19. A mobile wireless transceiver comprising:

a receiver for receiving a wireless signal of transfer information including position information of an information origin initially transmitting information and position information of a transmission source;

a detector for detecting a position of the mobile wireless transceiver itself;

a transmitter for transmitting a wireless signal; and

a controller for judging whether an angle between a first line connecting information origin and the transmission source and a second line connecting the transmission source and the mobile wireless transceiver itself is within a predetermined angle or not by using the position information of the information origin and the position information of the transmission source, and determining that the transfer information is not to be transferred by the transmitter if the angle between the first and second lines is not within the predetermined angle.

20. The transceiver according to claim 19, wherein the predetermined angle is determined based on a density of mobile wireless transceivers in the vicinity which is obtained using the position information of the transmission sources of a plurality of wireless signals received by the receiver.

21. A mobile wireless transceiver comprising:

a receiver for receiving a wireless signal of transfer information which includes position information of an information origin initially transmitting information and position information of a transmission source;

a transmitter for transmitting the wireless signal; and

a controller for detecting an average distance between the mobile wireless transceiver itself and other mobile wireless transceivers using the position information of the transmission sources of a plurality of wireless signals received by the receiver, judging whether the mobile wireless transceiver itself is within an area surrounded with two lines which contact with a circle or not by using the position information of the information origin and the position information of the transmission source, wherein the center of the circle is located at a position apart from the transmission sourc by a receiving lim-

itation distanc of wireless signals as well as on a line connecting the information origin and the transmission source, and the radius of the circle is equal to the average distance, and determining that the received information is not to be transferred if the mobile wireless transceiver is not within the area.

22. The transceiver according to claim 21, wherein the controller judges whether a distance from the transmission source is greater than or equal to a value obtained by subtracting the average distance from the receiving limitation distance, and determines that the transfer information is not to be transmitted by the transmitter if the distance is shorter than the value.

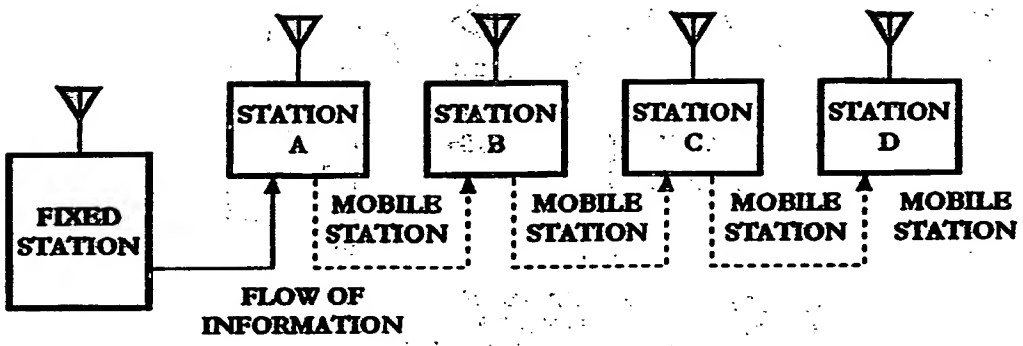
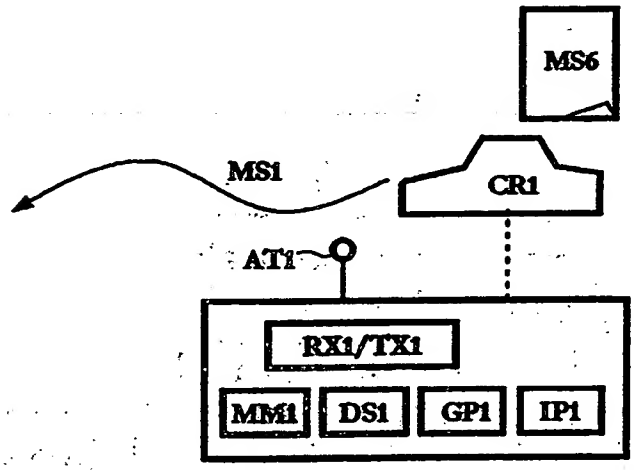


FIG. 1



AT1 ... ANTENNA
CR1 ... MOBILE OBJECT
DS1 ... DISPLAY DEVICE
GP1 ... GPS DRIVE
IP1 ... INPUT DEVICE
MM1 ... MEMORY
MS1 ... TRAFFIC INFORMATION MESSAGE
MS6 ... MAIL INFORMATION MESSAGE
RX1 ... WEAK RADIO WAVE RECEIVING DEVICE
TX1 ... WEAK RADIO WAVE TRANSMITTING DEVICE

FIG. 2

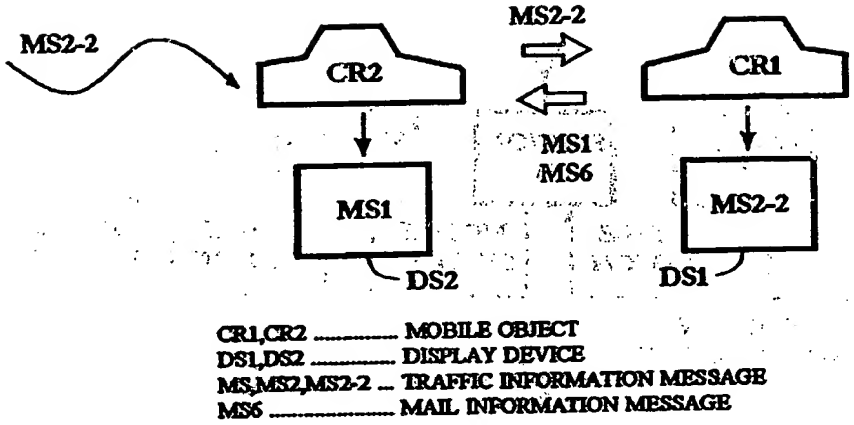

MS2-2
CR2
MS2-2
CR1
MS1
MS6
MS1
MS2-2
DS2
DS1
CR1,CR2 ..... MOBILE OBJECT
DS1,DS2 ..... DISPLAY DEVICE
MS,MS2,MS2-2 ... TRAFFIC INFORMATION MESSAGE
MS6 ..... MAIL INFORMATION MESSAGE

FIG. 3

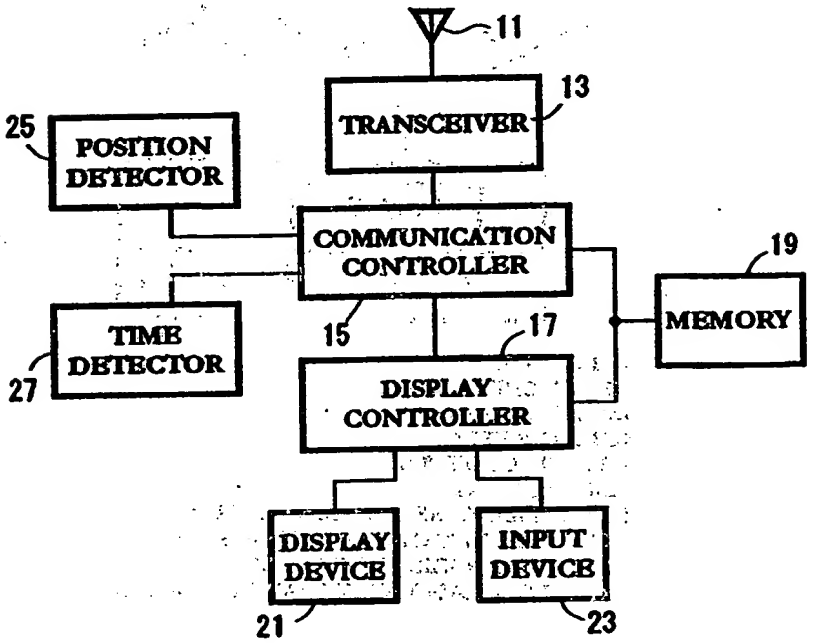

11
13
TRANSCEIVER
25
POSITION DETECTOR
COMMUNICATION CONTROLLER
19
MEMORY
TIME DETECTOR
27
15
17
DISPLAY CONTROLLER
DISPLAY DEVICE
21
INPUT DEVICE
23

FIG. 5

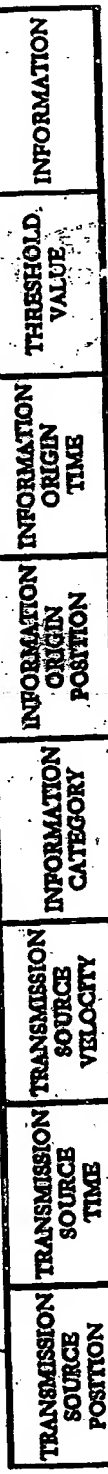

TRANSMISSION SOURCE POSITION
1
TRANSMISSION SOURCE TIME
2
TRANSMISSION SOURCE VELOCITY
3
INFORMATION CATEGORY
4
INFORMATION ORIGIN POSITION
5
INFORMATION ORIGIN TIME
6
THRESHOLD VALUE
7
INFORMATION
8

FIG. 4

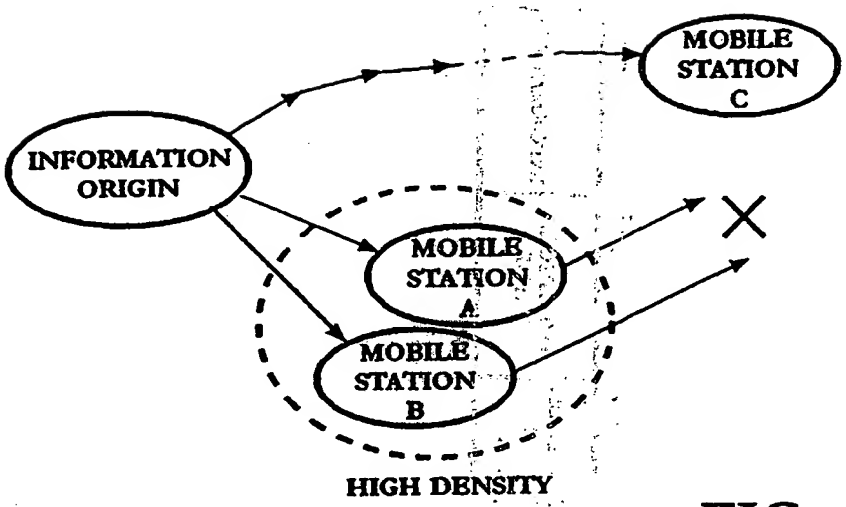

MOBILE STATION C
INFORMATION ORIGIN
MOBILE STATION A
MOBILE STATION B
HIGH DENSITY

FIG. 6

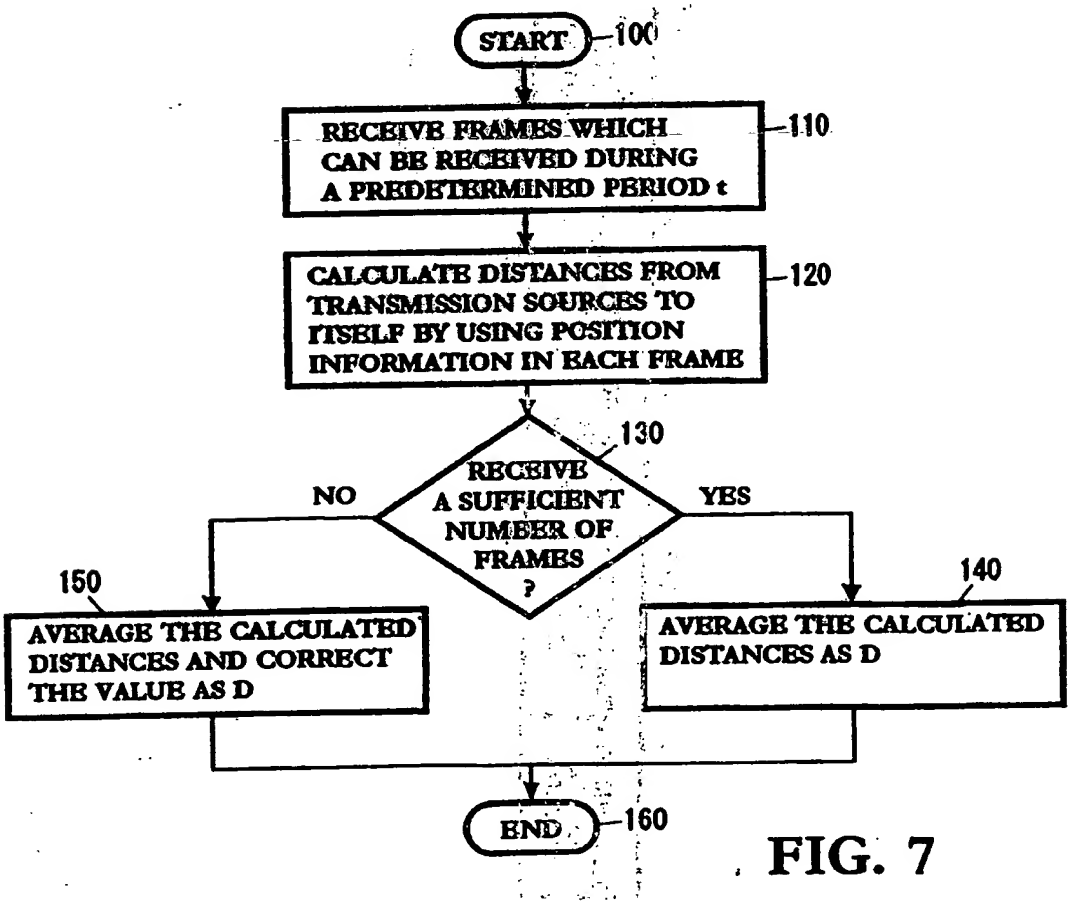
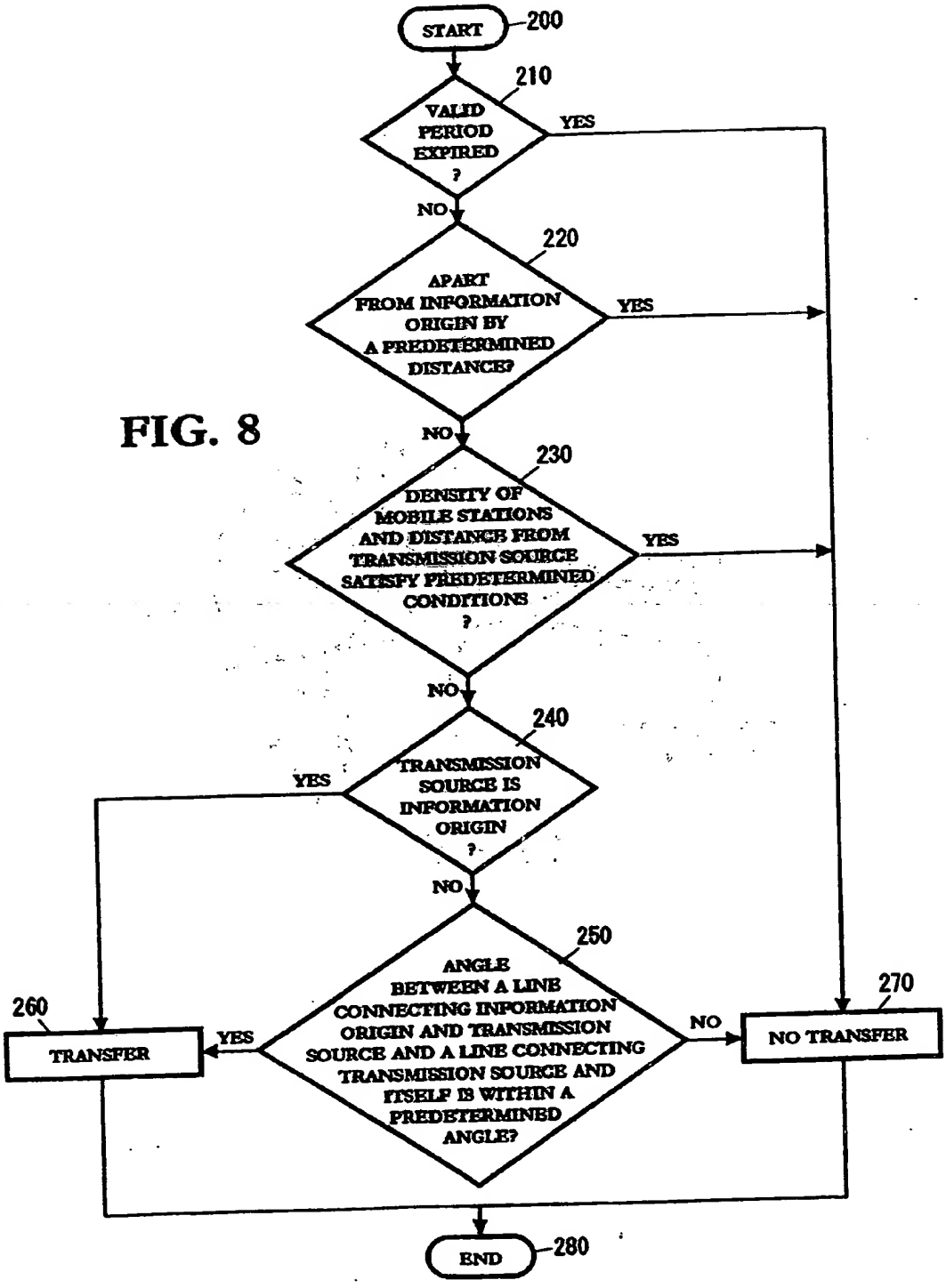

START
100
RECEIVE FRAMES WHICH CAN BE RECEIVED DURING A PREDETERMINED PERIOD t
110
CALCULATE DISTANCES FROM TRANSMISSION SOURCES TO ITSELF BY USING POSITION INFORMATION IN EACH FRAME
120
RECEIVE A SUFFICIENT NUMBER OF FRAMES ?
130
NO
YES
150
AVERAGE THE CALCULATED DISTANCES AND CORRECT THE VALUE AS D
140
AVERAGE THE CALCULATED DISTANCES AS D
END
160

FIG. 7

FIG. 8


START
200
210
VALID PERIOD EXPIRED ?
YES
NO
220
APART FROM INFORMATION ORIGIN BY A PREDETERMINED DISTANCE?
YES
NO
230
DENSITY OF MOBILE STATIONS AND DISTANCE FROM TRANSMISSION SOURCE SATISFY PREDETERMINED CONDITIONS ?
YES
NO
240
TRANSMISSION SOURCE IS INFORMATION ORIGIN ?
YES
NO
250
ANGLE BETWEEN A LINE CONNECTING INFORMATION ORIGIN AND TRANSMISSION SOURCE AND A LINE CONNECTING TRANSMISSION SOURCE AND ITSELF IS WITHIN A PREDETERMINED ANGLE?
YES
NO
260
TRANSFER
270
NO TRANSFER
END
280

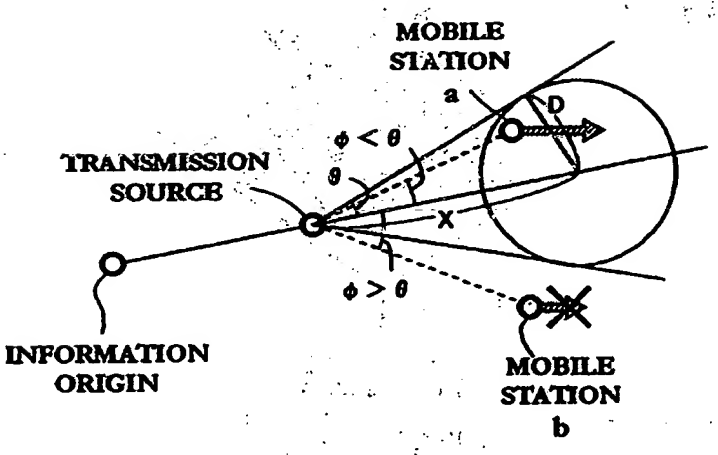

MOBILE
STATION
a
D
φ < θ
θ
TRANSMISSION
SOURCE
X
φ > θ
INFORMATION
ORIGIN
MOBILE
STATION
b

FIG. 9

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Office européen des brevet

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(54) Mobile wireless transceiver and transfer method

(57) Information transmitted from an information origin is transferred from one mobile station to another. At this time, in the mobile station, the transmission of the information is controlled so that the information is not transmitted to a distance more than a predetermined value from the position of the information origin. A valid period of the information is defined and only the information within the valid period is transmitted. Alternatively, controls are carried out in order to avoid overlapping of the transfer paths and detours of them. Particularly, if a density of the mobile stations becomes high, the quantity of the information to be transferred increases tremendously. Therefore, it is necessary to select and limit the information to be transferred.

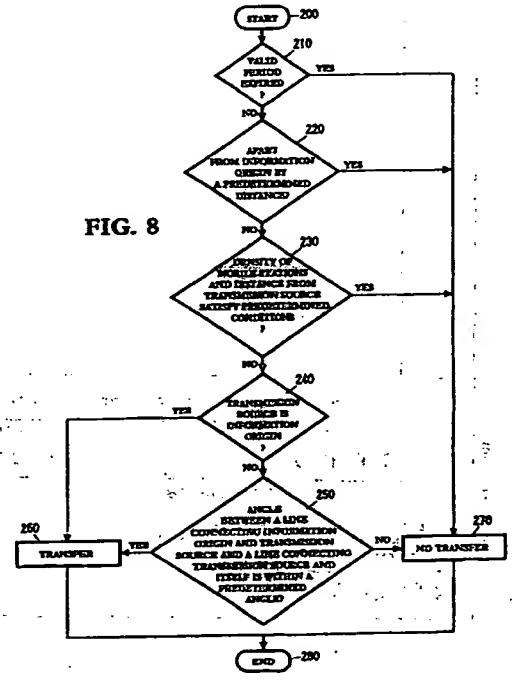

FIG. 8

EP 0 948 222 A3

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 99 30 1865

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A,D	PATENT ABSTRACTS OF JAPAN vol. 1998, no. 01, 30 January 1998 (1998-01-30) -& JP 09 252277 A (MEIDENSHA CORP), 22 September 1997 (1997-09-22) * abstract *	1-22	H04Q7/22
A	US 5 666 661 A (GRUBE GARY W ET AL) 9 September 1997 (1997-09-09) * column 2, line 31 - column 4, line 17 *	1-22	
A	EUROPEAN TELECOMMUNICATIONS STANDARDS INSTITUTE: "RADIO EQUIPMENT AND SYSTEMS (RES); HIGH PERFORMANCE RADIO LOCAL AREA NETWORK (HIPERLAN) TYPE1; FUNCTIONAL SPECIFICATION" EUROPEAN TELECOMMUNICATION STANDARD, ETS 300 652, October 1996 (1996-10), pages 1-112, XP002135544 SOPHIA ANTIPOLIS, FRANCE * page 25, line 11 - line 21 * * page 27, line 39 - line 48 * * page 54, line 1 - line 36 *	1-22	TECHNICAL FIELDS SEARCHED (Int.Cl.6) H04Q

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	12 April 2000	Heinrich, D

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 99 30 1865

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12-04-2000

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 09252277 A	22-09-1997	NONE	
US 5666661 A	09-09-1997	NONE	

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82